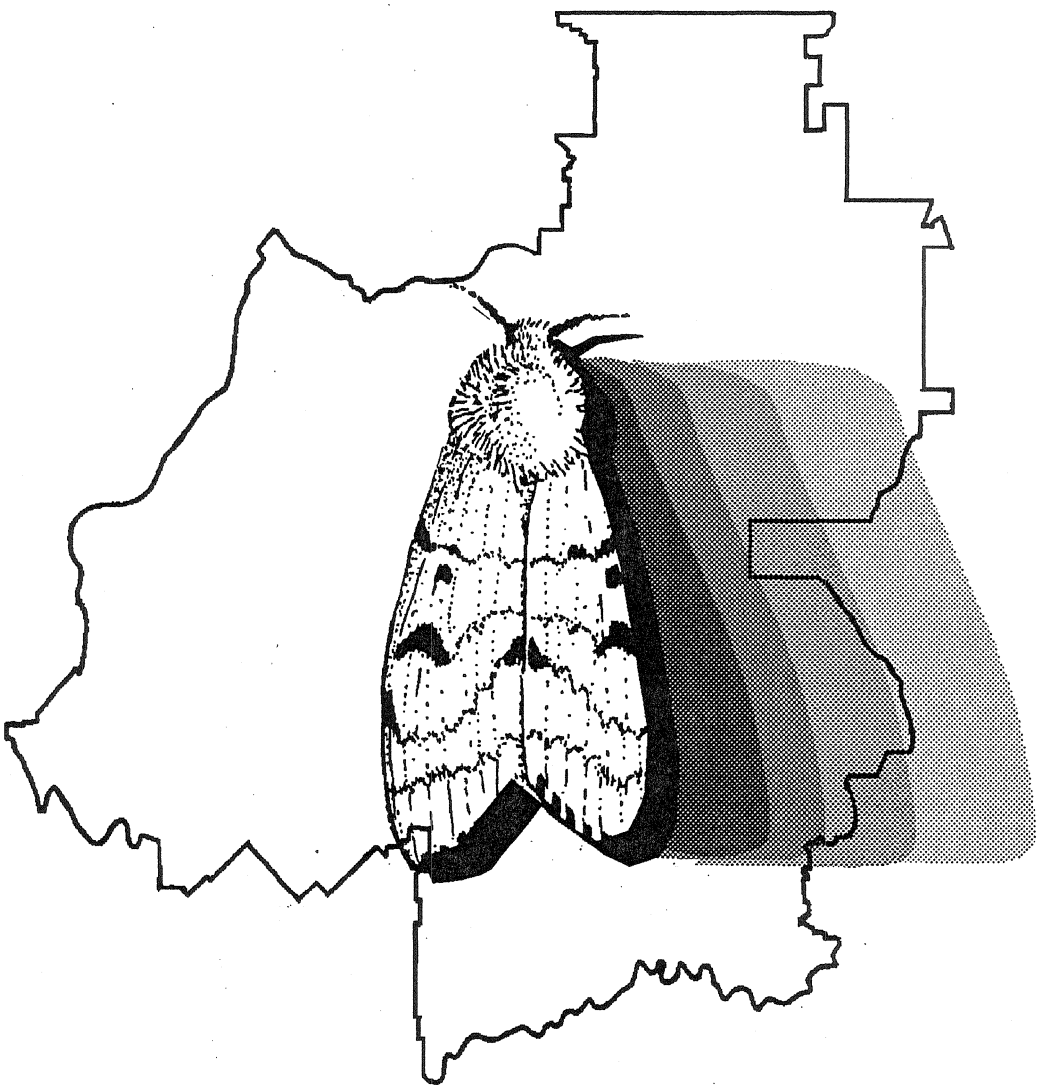
BIOLOGICAL EVALUATION OF GYPSY MOTH POPULATIONS, ALLEGHENY NATIONAL FOREST, PENNSYLVANIA 1992



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NORTHEASTERN AREA
State and Private Forestry

BIOLOGICAL EVALUATION OF GYPSY MOTH POPULATIONS, ALLEGHENY NATIONAL FOREST, PENNSYLVANIA 1992

ABSTRACT

Egg mass densities for the current generation of the gypsy moth, *Lymantria dispar* (Linneaus), have increased within much of the Allegheny National Forest (ANF), Pennsylvania. Several forested areas have population densities which approach, or exceed, moderate to severe defoliation/damage thresholds of 750 + egg masses per acre and require spraying. Approximately 16,500 acres have densities of 750-8000 egg masses per acre, which exceed these minimum levels (Map 1).

Areas of potentially defoliating populations should be considered for spraying during the spring of 1993 to prevent additional tree mortality, nuisance, and to maintain species diversity for wildlife and forest health.

INTRODUCTION

Moderate defoliation (31-60 percent) was detected on over 13,000 acres of the Allegheny National Forest in 1992. During the eight year period from 1984-1992, a total of over 223,500 acres have been defoliated by the gypsy moth. As a result of this defoliation, substantial oak tree mortality, and subsequent salvage sales, have occurred within the Sheffield, Bradford, and Marienville Ranger Districts. There is also concern among the ANF land managers as to the affects of the tree mortality on the way the oak forest type should be managed.

Tree mortality has also forced Forest Health Protection to alter the location and process in which the oak forest type is sampled to estimate gypsy moth populations. Originally, only high value timber stands and developed recreation sites were considered when planning ANF suppression projects. Following the oak mortality of 1988, priorities for selecting spray blocks are now based on maintaining the overall tree species diversity throughout the Forest.

A biological evaluation was conducted during September and October to assess gypsy moth population and to determine the likelihood of additional unacceptable impacts on the Forest resources.

METHODS

During this year's survey, 1/40th acre plots were used to estimate egg mass densities within susceptible forest type areas. Only high priority areas were surveyed due to resource and time limitations.

Over 1100 1/40th acre plots were randomly selected throughout the susceptible forest type on the ANF, (Map 2). At each survey point, a range pole with a target at a height of 5 feet was placed at plot center; the surveyor then used a 10 BAF prisem to sight on the target and establish an 18.6 foot radius plot boundary. An imaginary cylinder was extended from the ground through the canopy and all new egg masses within this cylinder were tallied. The plot counts were multiplied by 40 to calculate the egg mass densities per acre.

Additional information taken at these sample plots included the approximate percentage of oak in the stand by percent cover to help interpret variations in egg mass counts. Also, the general size of the egg masses and the presence of adult wasp parasites, *Ooencyrtus kuvanae* (Howard), on the egg masses were noted as an indication of gypsy moth population health and whether it is declining or increasing.

Data were analyzed using the relationship between egg mass density and defoliation of host type published by Gansner.

RESULTS

Gypsy moth populations have increased substantially within several areas on the Allegheny National Forest. Map 1 shows the location of the areas where moderate to severe defoliation is expected based on the results of the egg mass survey. See Table 1.

Table 1. -- 1992 Gypsy moth egg mass survey results,
Allegheny National Forest

Area	District	Average Egg Mass/Acre	Egg Mass Size	Approx % Oak Plots	% of Plots with Parasites	1992-1993 Population Trend
1	Bradford	2300	Large	64	18	Increasing
2	"	1440	"	69	0	"
3	"	1420	"	58	0	"
4	"	1400	"	75	0	"
5	Sheffield	880	"	76	33	"
6	"	1360	"	81	21	"
7	"	960	"	43	83	Decreasing
8	Marienville	1440	"	62	100	"
9	"	960	Med/Lge	71	50	Increasing
10	Ridgeway	1090	"	32	0	"
					Average 30%	

Population densities are increasing and the vigor of the populations also seem to be increasing slightly. This year's egg masses are somewhat larger (large as compared to medium/large egg masses in 1991) and parasitism has decreased to approximately 30 percent with last year's average being approximately 50 percent.

Table 2 shows the predicted moderate and severe defoliation, by district, for the Forest.

Table 2.--Predicted acres defoliation by district

Ranger District	Moderate	Severe
Bradford	8665	7510
Marienville	3575	990
Ridgway	500	0
Sheffield	935	525
Totals	13675	9025

DISCUSSION

In past projects, densities of 250 and 500 egg masses per acre have been used as thresholds for treatment within developed recreation sites and visual corridors respectively. The 1992 treatment threshold of 750 egg masses per acre was based on the linear relationship between egg mass density and defoliation of host type as published by David Gansner, NEFES, Radnor, PA. This states that greater than 750 egg masses per acre can be expected to cause moderate defoliation (30-60 percent) and greater than 1500 egg masses per acre can result in severe defoliation (60-100 percent).

It is possible that gypsy moth populations could collapse on their own due to the presence of nucleopolyhedrosis virus (NPV) or the more recently recognized fungal pathogen *Entomophaga maimaiga*. In areas with defoliating level gypsy moth populations (greater than 250 egg masses per acre) viral and fungal epizootics generally manifest themselves after significant tree defoliation has already occurred. Gypsy moth populations will usually peak in 2-3 years once they reach defoliating levels and then collapse as a result of NPV or fungal activitiy. Residual populations following such a collapse will likely remain at low densities for 3-6 years before rebuilding to defoliating levels. Although it is not possible to accurately assess such events with the information at hand, the large egg mass size and the recent population build-up suggest that this population as a whole is still building.

Trees that are defoliated in excess of 40 percent normally refoliate the same growing season. Such events cause the trees to expand valuable energy reserves to refoliate, and consequently cause the trees' health to deteriorate. Depending on the condition of the trees at the time of defoliation, reduced growth, branch dieback or in some cases tree mortality, are likely to occur following a single year of heavy defoliation. Should defoliation occur again the following year, the impact is compounded. Trees that receive light-moderate defoliation (<40 percent) generally will not refoliate and there is probably no significant impact other than some reduction in growth.

Because of the substantial upward shift in gypsy moth population densites, the localized "hotspots" (high population areas) that exist, the past history of gypsy moth, and the abundance of gypsy moth susceptible tree species in areas where gypsy moth populations are on the increase on the Allegheny National Forest, suppression should be considered for FY 93. In addition, yearly detection and evaluation monitoring needs to be continued to insure that increasing populations are detected.

TREATMENT ALTERNATIVES

NO ACTION

If the no action alternative is chosen, the potential exists for nuisance level larval populations and moderate to severe defoliation in isolated areas across the ANF. Should such defoliation occur, there is a high probability of additional tree mortality. Further, should no intervention action occur to reduce gypsy moth populations in 1993, it is likely that population densities will increase and possibly expand to currently uninfested areas in 1994.

USE OF CHEMICAL INSECTICIDE

A second option is to use a chemical insecticide to control gypsy moth populations. Dimilin® (diflubenzuron) is the most widely used chemical insecticide in gypsy moth suppression projects in the northeast. Diflubenzuron (DFB) is an insect growth regulator that disrupts the normal molting processes of the larvae. The mode of action is to inhibit the formation of chitin, a necessary component of the outer cuticle which causes the

affected larvae to die during the molt following treatment. The method of uptake is primarily by ingestion, however, recent research has indicated the possibility of absorption through the cuticle as well.

Dimilin is registered by EPA for use in residential areas. It is however, extremely toxic to some aquatic invertebrates, and the label prohibits it's application over open water or wetlands. With proper application, foilage protection and a significant population reduction can be expected with DFB. The need for treatment of residual populations the following year would be unlikely.

USE OF MICROBIAL INSECTICIDE

The third option is to use a microbial insecticide to manage gypsy moth populations. The only biological insecticide currently registered and commercially available for gypsy moth control is the insecticide *Bacillus thuringeiensis* variety *kurstaki* (*B.t.k.*). This insecticide is available through several manufacturers and has been used extensively in suppression projects throughout the U.S. in both forested and residential areas. *B.t.* is a bacterium that acts specifically against lepidopterous larvae as a stomach poison and therefore must be ingested. The major mode of action is by mid-gut paralysis which occurs soon after feeding. This results in a cessation of feeding, and death by starvation.

B.t. formulations are available as flowable concentrates, wettable powders, and emulsifiable suspensions. The normal application rates range from 16-30 billion international units (BIUs) per acre in a single application and 16-30 BIUs in double applications, *B.t.* can be applied either undiluted or mixed with water for a total volume of 1/2 - 1 gallon per acre. With proper application, foliage protection and some degree of population reduction can be expected with one application. With two applications, both foliage protection and a significant population reduction is likely. The degree of population reduction varies and may depend on the selected application rate, population densities, and the weather (rain and temperature) and the feeding activity of the larvae following treatment.

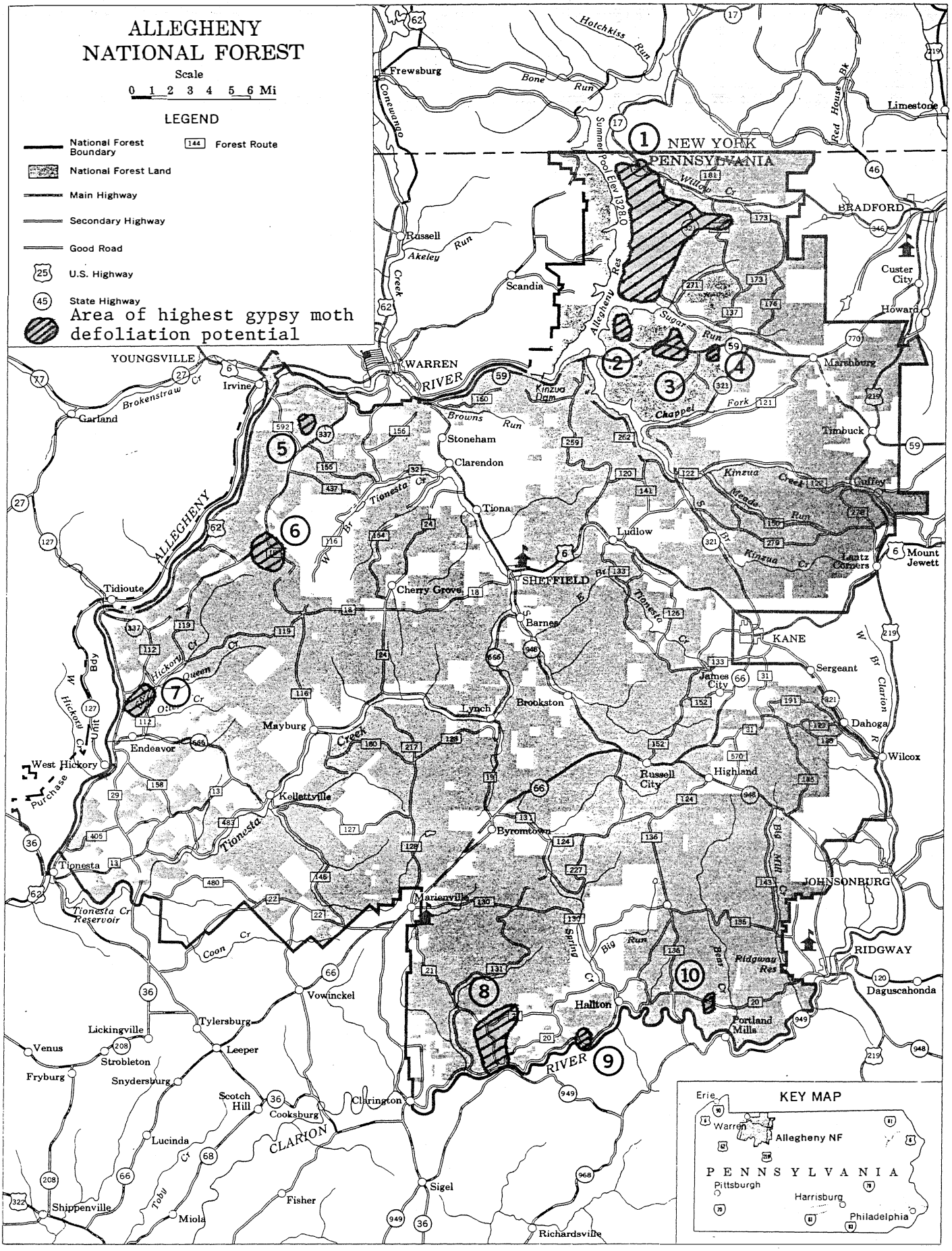
RECOMMENDATIONS

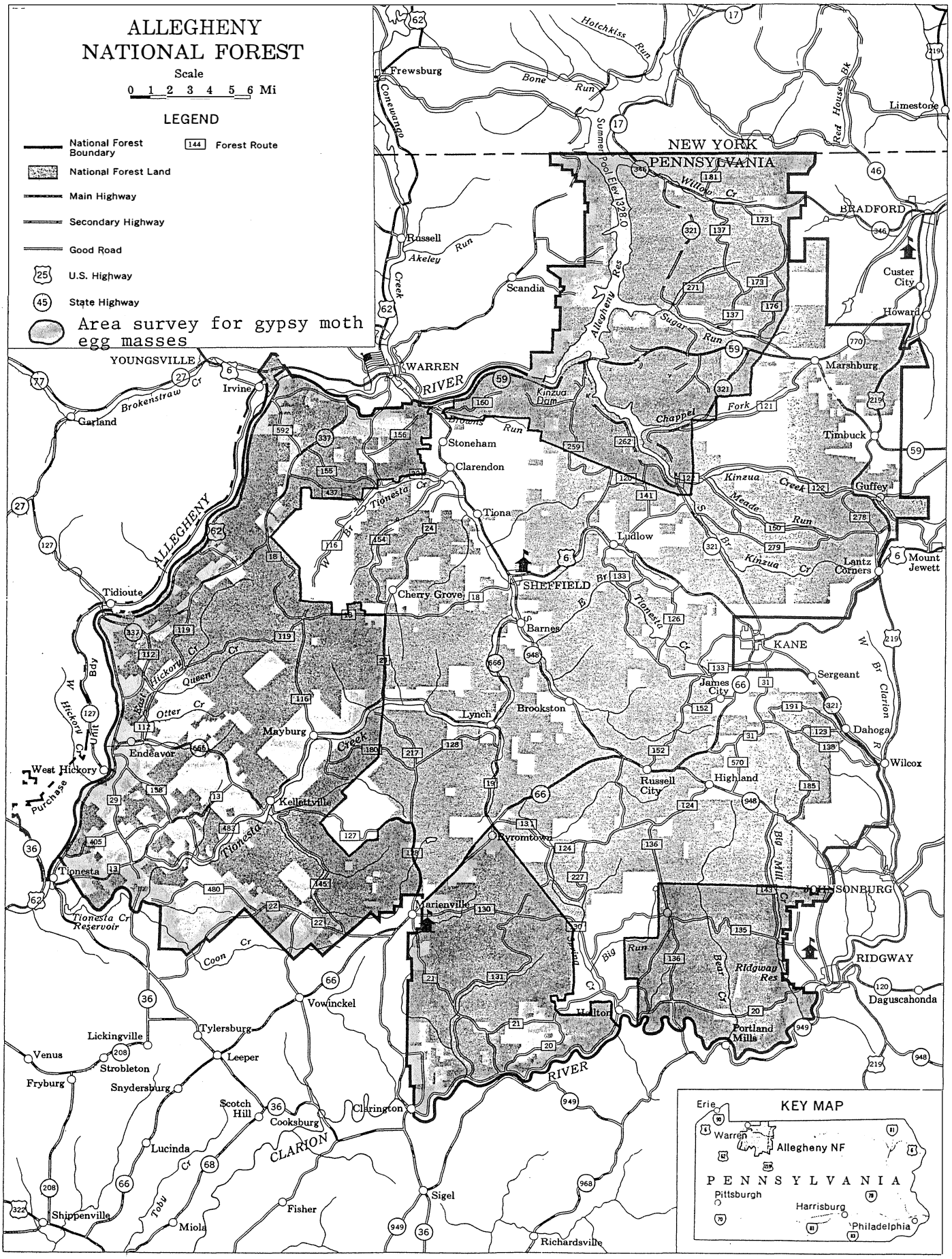
Potentially damaging gypsy moth populations exist within several areas of susceptible forest type on the Allegheny National Forest and occur within stands managed for tree species diversity, timber, and recreation. Basically, the ANF managers have two options:

1) no action
2) aerially spray in selected areas to prevent nuisance, defoliation, and subsequent tree mortality

Although research has shown that second outbreak episodes of gypsy moth result in reduced tree mortality rates, the Allegheny National Forest may not want to gamble on additional oak mortality occurring in stands defoliated during previous outbreaks. For this reason, we recommend the suppression alternative. National Forest resource values such as recreation, timber, and tree species diversity would be protected by suppressing building gypsy moth populations rather than waiting until a large scale outbreak develops.

Map 1.


ALLEGHENY
NATIONAL FOREST
Scale
0 1 2 3 4 5 6 Mi
LEGEND
National Forest Boundary
144 Forest Route
National Forest Land
Main Highway
Secondary Highway
Good Road
25 U.S. Highway
45 State Highway
Area of highest gypsy moth defoliation potential
NEW YORK
PENNSYLVANIA
Hotchkiss Run
Frewsburg
Bone Run
Conewango Creek
Summer Pool Elev 1328.0
Red House Br
Limestone
Willow Cr
BRADFORD
Russell
Akeley Run
Scandia
Allegheny Res
Sugar Run
Custer City
Howard
Marshburg
YOUNGSVILLE
Brokenstraw Cr
Irvine
Garland
WARREN
ALLEGHENY RIVER
Kinzua Dam
Browns Run
Chappel Fork
Stoneham
Clarendon
Timbuck
Tionesta Cr
Tiona
Kinzua Creek
Mead Run
Cuffey
Ludlow
Lantz Corners
Mount Jewett
Tidioute
Cherry Grove
SHEFFIELD
Barnes
Hickory Cr
Queen Cr
W Hickory Cr
W Hickory Unit Bdy
Purchase Unit
KANE
Sergeant
James City
Brookston
Lynch
Mayburg
Endeavor
West Hickory
Kellettville
Tionesta
Tionesta Cr Reservoir
Coon Cr
Dahoga
Wilcox
Russell City
Highland
Byromtown
Big Mill Cr
JOHNSONBURG
Marienville
Spring Cr
Big Run
Ridgway Res
RIDGWAY
Dagus cahonda
Vowinckel
Halton
Portland Mills
Tylersburg
Lickingville
Venus
Strobleton
Leeper
Fryburg
Snydersburg
Scotch Hill
Cooksburg
Clarington
CLARION RIVER
Lucinda
Toby Cr
Shippenville
Miola
Fisher
Sigel
Richardsville
KEY MAP
Erie
Warren
Allegheny NF
PENNSYLVANIA
Pittsburgh
Harrisburg
Philadelphia


ALLEGHENY
NATIONAL FOREST
Scale
0 1 2 3 4 5 6 Mi
LEGEND
National Forest Boundary
144 Forest Route
National Forest Land
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45 State Highway
Area survey for gypsy moth egg masses
NEW YORK
PENNSYLVANIA
WARREN
YOUNGSVILLE
Irvine
Garland
Frewsburg
Russell
Scandia
Limestone
BRADFORD
Custer City
Howard
Marshburg
Timbuck
Guffey
Stoneham
Clarendon
Tiona
Ludlow
SHEFFIELD
Cherry Grove
Barnes
Tidioute
Lantz Corners
Mount Jewett
KANE
Sergeant
James City
Brookston
Lynch
Mayburg
Endeavor
West Hickory
Kellettville
Tionesta
Dahoga
Wilcox
Russell City
Highland
Pyrmotown
Marienville
JOHNSONBURG
RIDGWAY
Daguscahonda
Portland Mills
Halton
Vowinkel
Tylersburg
Lickingville
Venus
Strobleton
Leeper
Fryburg
Snydersburg
Scotch Hill
Cooksburg
Clarington
Lucinda
Shippenville
Miola
Fisher
Sigel
Richardsville
ALLEGHENY RIVER
CLARION RIVER
Tionesta Cr Reservoir
Kinzua Dam
Allegheny Res
Ridgway Res
Chappel Fork
Kinzua Creek
Meade Run
Sugar Run
Willow Cr
Summer Pool Elev 1328.0
Hotchkiss Run
Bone Run
Akeley Run
Brokenstraw Cr
Browns Run
Tionesta Cr
W Br Tionesta Cr
Hickory Cr
East Hickory Cr
Queen Cr
Otter Cr
Coon Cr
Big Run
Bear Cr
Big Mill Cr
W Br Clarion R
Rest House Pk
KEY MAP
Erie
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Allegheny NF
PENNSYLVANIA
Pittsburgh
Harrisburg
Philadelphia